MITSUBISHI

VARIABLE FREQUENCY DRIVES

FR-S SERIES

Make operations simple with the setting dial!

400V Class Now Available!

Mitsubishi Electric Corporation Nagoya Works is a factory certified for ISO14001 (standards for environmental management systems) and ISO9001(standards for quality assurance managememt systems)

ISO 14001 JACO UKAS ENVIRONMENTAL MANAGEMENT 051

BVQI ISO 9001 UKAS QUALITY MANAGEMENT 008

1

Quick Setting using Setting Dial

- The frequency and parameters etc. can be set with a few simple steps.
- Easily set values: turn quickly to greatly change the value, and turn slowly to finely adjust the value.
- Accurate settings can be made with the new notch-type "clicking" feel.

The setting dial is your new tool for operations!!

See how easy it is to make simple operation settings.

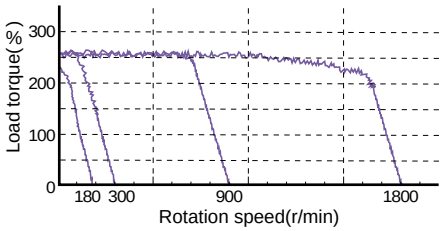
2

Simple Operation

- As the default, the parameters that can be set have been grouped into the minimum required twelve parameters. Thus, parameters can be managed easily.
- The modes can be changed between the PU and external operation modes just by pressing the PU/EXT (operation mode changeover) key. The current operation mode can be confirmed with the status display LED.
- The set frequency and the output current value can be monitored just by using the setting dial (set frequency monitor) or SET key (output current value monitor). (When in the monitor display state.)

Example of PU operation mode

3 Automatic Torque Boost Control



●By incorporating Mitsubishi's original and newly developed "automatic torque boost control", a maximum 150% torque at 6Hz is possible.
●The need for torque boost setting can be eliminated and the current during no load can be controlled.
Example speed-torque characteristics using newly developed automatic torque boost control is shown on the left.
(For SF-JR 4P 0.75kW motor)

4 Compact Design

●The foot print is the same as the Mitsubishi FREQROL-E520.
●(400V class installation area has been unified to 108mm(128m.)
●The height dimensions for all capacities have been unified to 128mm, making panel layout easier.

5 Environment Awareness

●The popular Soft-PWM control is incorporated as standard.
An increase in noise can be reduced, and noise can be suppressed to a minimum.
●Reactor connection to aid harmonic suppression.
The compact and lightweight DC reactor (FR-BEL) can be connected.
Connect an AC reactor (FR-BAL) when using the single-phase 100V class.

6 Easy Maintenance

●The cooling fan can be replaced easily due to a simple cassette design. By setting the fan "ON-OFF control", operation with an extended life can be realized. (The ON-OFF control is set as the default.)
●Wiring space is secured and the wiring work efficiency is enhanced by incorporating an expanded front cover and comb-type wiring cover.

7 Global specification

●Compatible with UL, cUL and EN (CE Mark).

8 Other Handy Functions

●Terminal function (multi-speed 15 of speeds, error reset, output stop, etc.) can be selected
●In-rush current suppression circuit is standard for all capacities
●PID control
●4 to 20mA input
●Sink/Source logic is selectable

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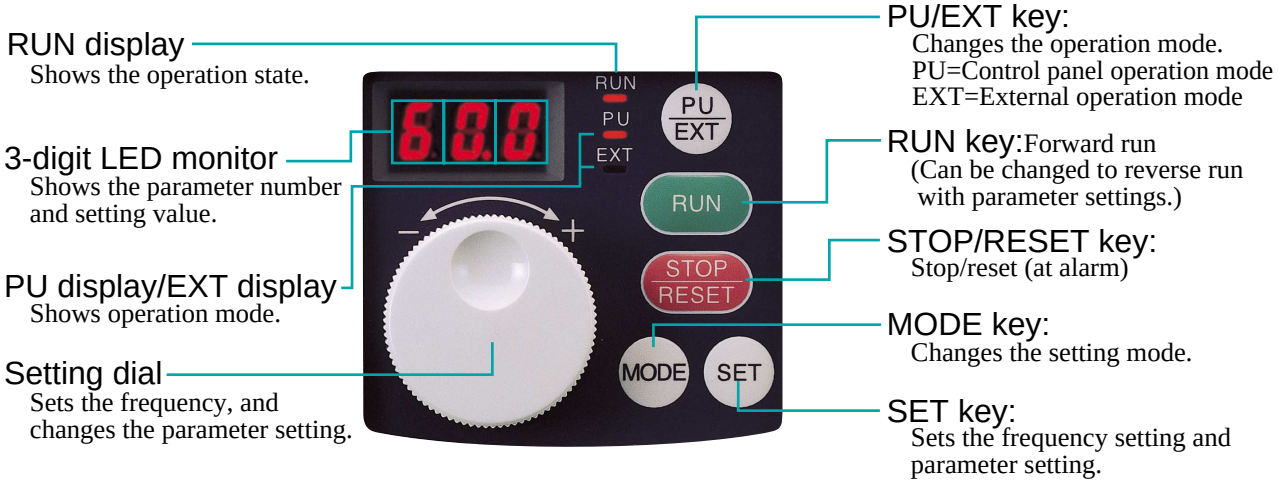
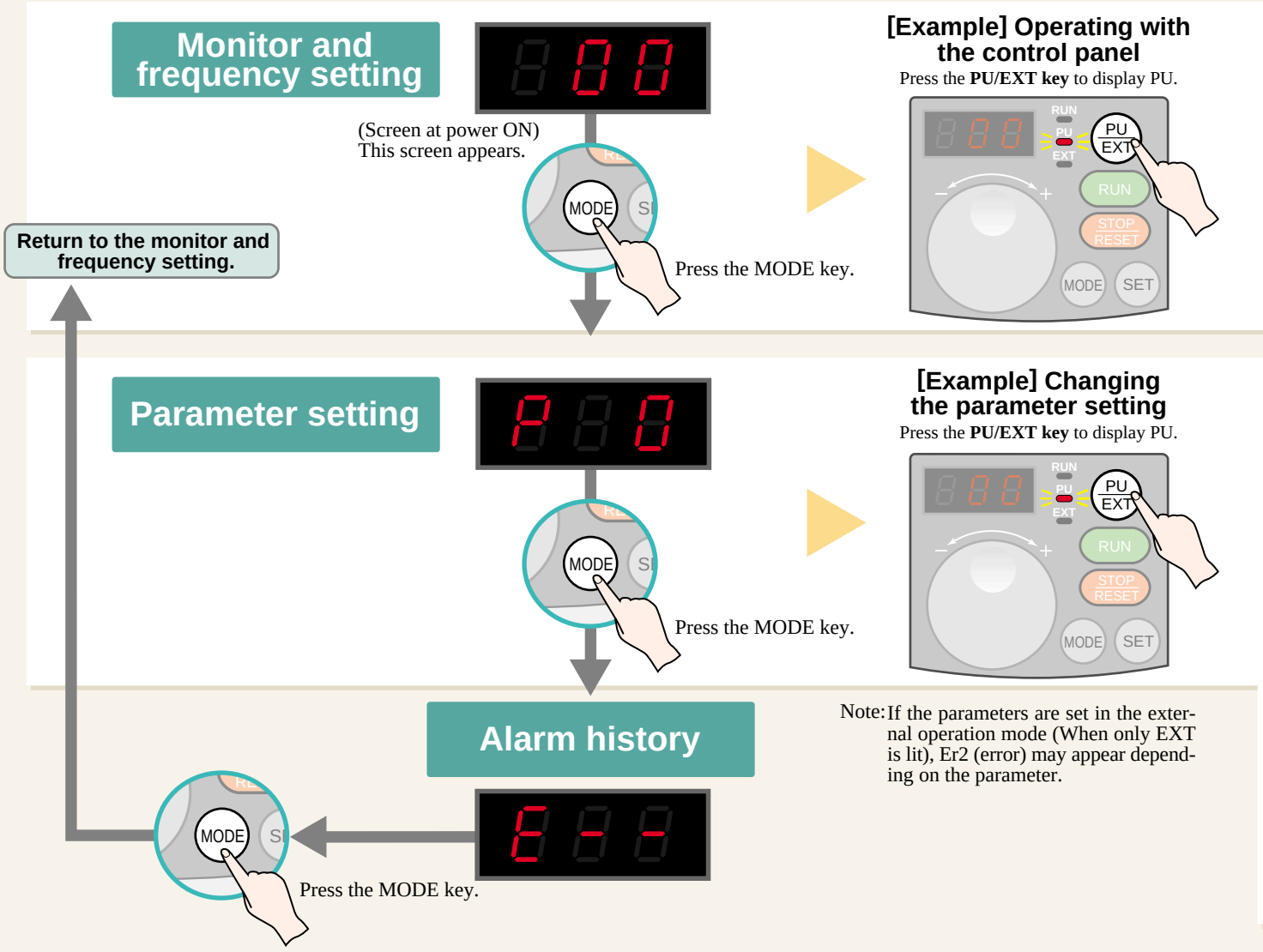
Control panel



Basic operations (At default setting)


Monitor and frequency setting
(Screen at power ON)
This screen appears.
Press the MODE key.
[Example] Operating with the control panel
Press the PU/EXT key to display PU.
Return to the monitor and frequency setting.
Parameter setting
Press the MODE key.
[Example] Changing the parameter setting
Press the PU/EXT key to display PU.
Alarm history
Press the MODE key.
Note: If the parameters are set in the external operation mode (When only EXT is lit), Er2 (error) may appear depending on the parameter.

Type

FR — S520 ☐ — 0.1K — ☐

Symbol	Voltage
1	100V class
2	200V class
4	400V class

Symbol	No. of power supply phases, etc.
None	3-phase input
S	Single-phase input
W	Single-phase input (double voltage output)

Symbol	Inverter capacity
0.1K ≀ 3.7K	Indicates capacity (kW)

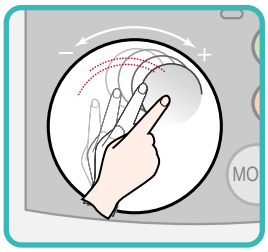
Symbol	Structure, communication function, etc.
None	Enclosed type
R	RS-485 function provided
C	Totally enclosed structure (IP40)

Model Configuration

Power specifications	Inverter type (The inverter capacity is shown in the box)	Inverter capacity 0.1K	0.2K	0.4K	0.75K	1.5K	2.2K	3.7K	Remarks
3-phase 200V	FR-S520-☐K	●	●	●	●	●	●	●	
	FR-S520-☐K-R								
	FR-S520-☐K-C								
3-phase 400V	FR-S540-☐K	—	—	●	●	●	●	●	
	FR-S540-☐K-R								
Single-phase 200V (Note)	FR-S520S-☐K	●	●	●	●	●	—	—	
	FR-S520S-☐K-R								
Single-phase 100V (Note)	FR-S510W-☐K	●	●	●	●	—	—	—	
	FR-S510W-☐K-R								

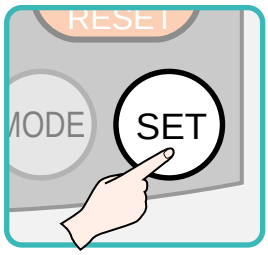
(Note) The output is 3-phase 200V.

●: Available model, —: No correspondence



Turn the setting dial.

The desired frequency setting will appear.



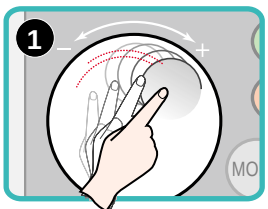
Press the SET key within 5s after turning the dial.

Writing of the frequency setting is completed!

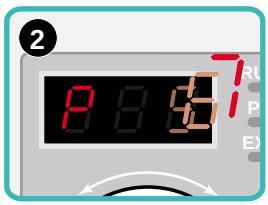
F and frequency flicker

Starts when RUN is pressed.

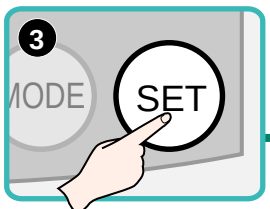
Stops when STOP RESET is pressed.



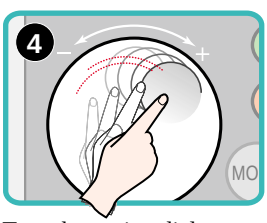
Turn the setting dial.



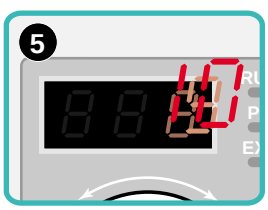
The parameter No. will appear.



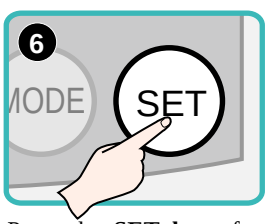
Press the **SET key** after turning the dial.
The currently set number will be read out.



Turn the setting dial.



The desired setting value will appear.



Press the **SET key** after turning the dial.

Setting of the parameters is completed!

Parameter No. and changed value flicker

Turn the setting dial, and set the number of the next parameter to be changed.

After reading and changing the setting:

- Press the MODE key once to return to the Alarm History screen.
- Press the MODE key twice to return to the Monitor and Frequency Setting screen.

General Specifications

Specifications		3-phase 200V							3-phase 400V					Single-phase 200V					Single-phase 100V			
		FR-S520-□□							FR-S540-□□					FR-S520S-□□					FR-S510W-□□			
Type		0.1K	0.2K	0.4K	0.75K	1.5K	2.2K	3.7K	0.4K	0.75K	1.5K	2.2K	3.7K	0.1K	0.2K	0.4K	0.75K	1.5K	0.1K	0.2K	0.4K	0.75K
Applicable motor capacity (kW) (Note 1)		0.1	0.2	0.4	0.75	1.5	2.2	3.7	0.4	0.75	1.5	2.2	3.7	0.1	0.2	0.4	0.75	1.5	0.1	0.2	0.4	0.75
Output	Rated capacity (kVA)(Note 2)	0.3	0.5	1.0	1.6	2.8	4.0	6.6	0.9	1.6	2.7	3.7	5.9	0.3	0.5	1.0	1.6	2.8	0.3	0.5	1.0	1.6
	Rated current (A)	0.8	1.4	2.5	4.1	7.0	10	16.5	1.1	2.1	3.5	4.8	7.7	0.8	1.4	2.5	4.1	7.0	0.8	1.4	2.5	4.1
	Overload current rating (Note 3)	150% for 60 s, 200% for 0.5 s (Inverse time characteristics)																				
	Voltage (Note 4)(Note 6)	3-phase 200 to 240V, 50/60 Hz							3-phase 380V to 480V, 50/60 Hz					3-phase 200 to 240V, 50/60 Hz					3-phase 200V to 230V, 50/60Hz			
Power supply	Rated input AC voltage/frequency	3-phase 200 to 240V, 50/60 Hz							3-phase 380V to 480V, 50/60 Hz					Single-phase 200 to 240V, 50/60Hz					Single-phase 100V to115V, 50/60Hz			
	Tolerable AC voltage fluctuation	170 to 264V, 50/60Hz							325V to 528V, 50/60Hz					170 to 264V, 50/60Hz					90V to 132V, 50/60Hz			
	Tolerable frequency fluctuation	Within ±5%																				
	Power facility capacity(kVA)(Note 5)	0.4	0.7	1.2	2.1	4.0	5.5	9	1.5	2.5	4.5	5.5	9.5	0.5	0.9	1.5	2.5	4.4	0.5	0.9	1.5	2.5
Protective structure (JEM 1030)		Enclosed type (IP20) (Fully enclosed structure series is IP40)							Enclosed type (IP20)													
Cooling method		Self-cooling				Forced cooling			Self-cooling		Forced cooling			Self-cooling				Forced cooling	Self-cooling			
Approximately weight (kg)		0.5	0.5	0.8	0.9	1.5	1.5	2.1	1.5	1.5	1.5	1.6	1.7	0.5	0.6	0.8	1.0	1.5	0.6	0.7	0.9	1.6

(Notes) 1. The applicable motor indicates the maximum applicable capacity when using a Mitsubishi standard 4-pole motor.
2. The rated output capacity is 230V for the 3-phase 200V output voltage, and 440V for the 3-phase 400V output voltage.
3. The overload current rating percentage indicates the percentage in respect to the inverter's rated output current. When used repeatedly, it is necessary to wait for the inverter motor to return to a temperature less than the temperature for the 100% load.
4. The maximum output voltage will not exceed the power supply voltage for the 3-phase 200V/400V power input specification product and the single-phase 200V power input specification product. The single-phase 100V power input specification product cannot output more than twice the power voltage.
5. The power capacity will change according to the power side impedance (including the input reactor or wire) values.
6. For the single-phase 100V power input specification product, when a load is applied on the motor, the output voltage will drop by approx. 10 to 15%. However, when using a general-purpose motor, the load must be reduced before use.

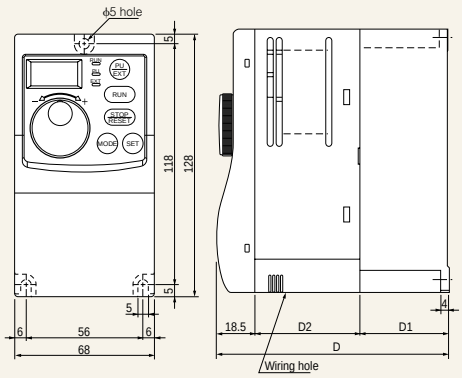
Common Specifications

Control specifications	Control method		Select from V/F control (Soft-PWM control/high carrier frequency PWM control selective) and automatic torque boost control
	Output frequency range		0.5 to 120Hz (starting frequency can be varied between 0 and 60Hz)
	Frequency setting resolution		5VDC input: 1/500 of maximum setting frequency, 10VDC, DC4 to 20mA input: 1/1000 of maximum setting frequency Digital input: 0.1Hz (less than 100Hz), 1Hz (100Hz or more)
	Frequency precision		Analog input: Within ±1% of maximum output frequency (25˚C ± 10˚C) Digital input: Within ±0.5% of set output frequency (when setting dial is used)
	Starting torque		150% (at 6Hz) during automatic torque boost control
	Acceleration/deceleration time setting		0,0.1 to 999 s (acceleration/deceleration can be set individually), linear or S-pattern acceleration/deceleration mode can be selected
	Braking torque	Regenerative (Note 1)	0.1K, 0.2K, ·· 150%, 0.4K, 0.75K,·· 100%, 1.5K, ·· 50%, 2.2K 3.7K··20%
		DC braking	Operation frequency (0 to 120Hz), operation time (0 to 10 seconds), operation voltage (0 to 15%)
	Input signals		Frequency setting signal (0 to 5 (10)VDC), 4 to 20mA, digital setting with setting dial, start signal, error reset (RES), multi-speed selection (RL, RM, RH, REX), 2nd function selection (RT), output stop (MRS), current input selection (AU), external thermal input (OH), start self-hold selection (STOP), JOG mode selection (JOG), PID action selection (X14), PU operation/external operation changeover (X16)
	Operation functions		Upper/lower limit frequency setting, frequency jump operation, external thermal input selection, restart after instantaneous power failure, forward/reverse run prevention, slip compensation, operation mode selection, PID control, computer link operation (RS-485) (Note 5)
	Output signals	Operation functions	One type of open collector output can be selected from inverter running (RUN), frequency reached (SU), frequency detection (FU), overload warning (OL), zero current detection (Y13), output current detection (Y12), PID upper limit (FUP), PID lower limit (FDN), PID forward/reverse run (RL), READY (RY), minor failure (LF), and error (A, B, C). One type can be selected for the contact output (1 contact, 230VAC 0.3A, 30VDC 0.3A).
		For meter	One type can be selected from output frequency or motor current. Pulse train output (1440 pulse/s 1mA full scale).
Protection and warning functions			Overcurrent cutoff (during acceleration, deceleration, and constant speed), regenerative overvoltage cutoff (during acceleration, deceleration, and constant speed), overload cutoff (electronic thermal relay), fin overheating, fan trouble (Note 4), stall prevention, output side ground fault protection at starting (Note 7), external thermal input (Note 6), PU dislocation (Note 5), No. of retries exceeded, communication error (Note 5), CPU error, undervoltage (Note 2)
Environment	Ambient temperature and humidity		−10˚C to +50˚C(non freezing), (−10˚C to + 40˚C for fully enclosed structure specifications), 90%RH or less(non condensing)
	Storage temperature (Note 3)		−10˚C to +65˚C
	Atmosphere		Indoors with no corrosive gases, flammable gases, oil mist or dust
	Altitude and vibration		1000m or less above sea level, 5.9m/s^2 or less (JIS C 0040 compliant)

(Notes) 1. The indicated braking toque is the short-term average torque (which changes with motor loss) when the motor alone is decelerated from 60Hz. It is not the continuous regenerative torque. Deceleration from frequencies exceeding the base frequency will have a lower average deceleration torque value.
2. If an undervotlage occurs, an error will not be output, but the output will be cutoff. Operation can be resumed after restoring the power, but depending on the operation state (size of load, etc.), the overcurrent protection or regenerative overvoltage protection may function when the power is restored.
3. This is the temperature to which units can be exposed for a short time, such as during transportation.
4. This corresponds only to the products with built-in cooling fan.
5. This applies only to the type with RS-485 function.
6. This functions only when the external thermal input (OH) is selected with Pr. 60 to Pr. 63 (input terminal function selection).
7. This functions only when Pr. 40 (start-time ground fault detection selection) is set to 1.

External Dimension Drawings (Unit: mm)

■FR-S520-0.1K, 0.2K, 0.4K, 0.75K
■FR-S520S-0.1K, 0.2K, 0.4K, 0.75K
■FR-S510W-0.1K, 0.2K, 0.4K



3-phase 200V power supply

Capacity	D	D1	D2
0.1/0.2K	80.5	10	52
0.4K	112.5	42	52
0.75K	132.5	62	52

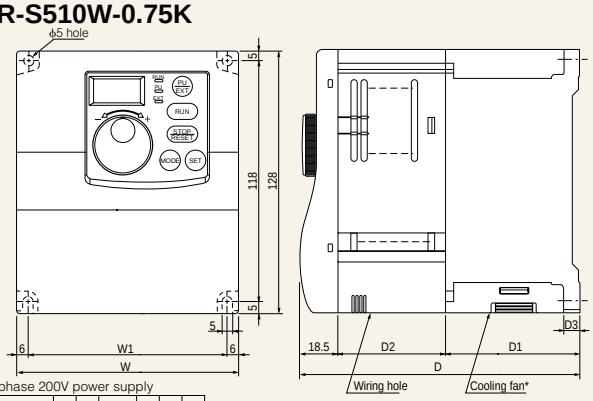
Single-phase 200V power supply

Capacity	D	D1	D2
0.1/0.2K	80.5	10	52
0.4K	142.5	42	82
0.75K	162.5	62	82

Single-phase 100V power supply

Capacity	D	D1	D2
0.1K	80.5	10	52
0.2K	110.5	10	82
0.4K	142.5	42	82

■FR-S520-1.5K, 2.2K, 3.7K
■FR-S540-0.4K, 0.75 K, 1.5K, 2.2K, 3.7K
■FR-S520S-1.5K
■FR-S510W-0.75K



3-phase 200V power supply

Capacity	W	W1	D	D1	D2	D3
1.5/2.2K	108	96	135.5	65	52	8
3.7K	170	158	142.5	72	52	5

3-phase 400V power supply

Capacity	W	W1	D	D1	D2	D3
0.4/0.75K	108	96	129.5	59	52	5
1.5K	108	96	135.5	65	52	8
2.2K	108	96	155.5	65	72	8
3.7K	108	96	165.5	65	82	8

Single-phase 200V power supply

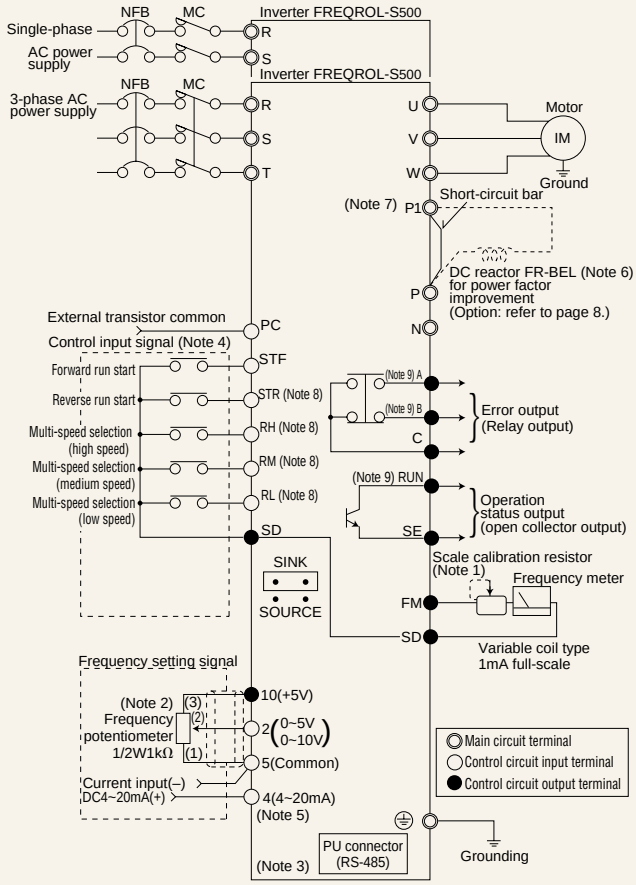
Capacity	W	W1	D	D1	D2	D3
1.5K	108	96	155.5	65	72	8

Single-phase 100V power supply

Capacity	W	W1	D	D1	D2	D3
0.75K	108	96	149.5	59	72	5

*The FR-S510W-0.75K FR-S540-0.4K,0.75K does not have a cooling fan.

Terminal connection diagram



(Notes)
1. This is not required when calibrating with the setting dial. Use this when calibrating the frequency meter manually because the frequency meter is at a remote location etc. Note that when the scale calibration resistor is connected, the needle on the frequency meter may not adjust to the full scale. In this case, calibrate with the setting dial.
2. If the setting unit is used frequently, use the 2W1kΩ potentiometer.
3. This is provided only with the type having the RS-485 function.
4. This is a connection example for when the control circuit logic is sink (default setting).
5. When using the current input for the frequency setting signal, set one of the parameters between Pr. 60 and Pr. 63 (terminal function selection) to 4, and assign one of the terminals RH, RM, RL or STR to AU (current input selection).
6. This cannot be mounted on the single-phase 100V power input specification product.
7. The single-phase 100V power input specification product does not have terminals.
8. The RL, RM, RH, RT, AU, STOP, MRS, OH, REX, JOG, RES, X14 and X16 signals can be selected with the input terminal function selection (Pr. 60 to 63).
9. The RUN, SU, OL, FU, RY, Y12, Y13, FDN, FUP, RL, LF, and ABC signals can be selected with the output terminal function selection (Pr. 64, 65).

Explanation of Terminals

Terminal symbol		Terminal name	Detailed explanation
Main circuit	R, S, T	Power supply input	Connect to the commercial power supply.
	U, V, W	Inverter output	Connect to the 3-phase squirrel cage motor.
	N	DC voltage common	This is the DC voltage common terminal. It is not insulated from the power supply and inverter output.
	P, P1	Power factor improvement DC reactor connection	Remove the short-circuit bar between terminals P and P1 and connect the optional power factor improvement DC reactor (FR-BEL). (This cannot be connected with the FR-S510W-☐☐K(-R).)
	⏚	Grounding	This is for grounding the inverter chassis. Always ground the inverter.
Control circuit (input signal)	STF	Forward run start	This functions as the forward run command when the STF signal is ON, and the stop command when the signal is OFF.
	STR	Reverse run start	This functions as the reverse run command when the STR signal is ON, and the stop command when the signal is OFF. If the STF and STR signals turn ON simultaneously, these will function as the stop command.The terminal function will change according to the input terminal selection (Pr. 60 to Pr. 63) Refer to the input signals in the common specifications on page 4 for details on the terminal functions that can be changed.
	RH, RM, RL	Multi-speed selection	The multi-speed type can be selected by combining the terminal RH, RM and RL signal short circuits.
	SD	Contact input common (sink)	This is the common terminal for the contact input (terminals STF, STR, RH, RM, RL) and meter connection (terminal FM). Terminal 5 and terminal SE are insulated.
	PC	External transistor common 24VDC power supply contact input common (source)	When connecting a transistor output (open collector output) such as a programmable controller (PLC), malfunctioning caused by the supplied current can be prevented by connecting the external power supply common for the transistor output to this terminal.This can be used as the 24VDC 0.1A power supply between terminals PC and SD. When the source logic is selected, this will be the common terminal for the contact input signal.
	10	Frequency setting power supply	5VDC. Tolerable load current 10mA.
	2	Frequency setting (voltage signal)	When 0 to 5VDC (0 to 10V) is input, the maximum output frequency will be reached at 5V (10V), and the input/output will be proportional. Change between 5V and 10V with Pr. 73. The input resistance is 10kΩ, and the maximum tolerable input voltage is 20V.
	5	Frequency setting input common	This is the common terminal for the frequency setting signal (terminal 2, 4). This is insulated from terminal SD and terminal SE. Do not ground this common.
	4	Frequency setting (current signal)	Input 4 to 20mA DC.The default setting is adjusted to 0Hz at 4mA and 60Hz at 20mA.The maximum tolerable input current is 30mA, and the input resistance is appoximately 250Ω.
Control circuit (output signal)	A, B, C	Error output (relay output)	1 relay output which indicates that the inverter protective function has activated and the output has stopped. 230VAC 0.3A 30VDC 0.3A. When there is an error, there is non-continuity between B-C (continuity between A-C), and during normal operation, there is continuity between B-C (non-continuity between A-C). The terminal function will change according to the output terminal function selection (Pr.64,65). Refer to the output signals in the common specifications on page 4 for details on the terminal functions that can be changed.
	RUN	Inverter running	The L level is output when the inverter output frequency is higher than the starting frequency (0.5Hz default can be changed). The H level is output when stopped or during DC braking (Note 1). The tolerable load is 24VDC 0.1A.
	SE	Open collector common	This is the common terminal for the terminal RUN. This is insulated from terminal 5 and terminal SD.
	FM	Display connection	The inverter is set so that the terminals FM to SD will output approximately 1mA at 60Hz (default value). The output frequency is proportional. The output voltage is a pulse waveform, so a digital display can be connected. Pulse specifications: 1440 pulses/s at 60Hz.
Communication	—	RS-485 connector (Note 2)	Communication with RS-485 is possible. •Standard compliance: EIA Standards RS-485 •Transmission format: Multidrop link method •Communication speed: Max. 19200 baud, •Total length: 500m The parameter unit FR-PU04 can be connected using the parameter unit connection cable FR-CB201 to 205.

(Notes)
1. The L level refers to when the open collector output transistor is ON (continuity state). The H level refers to when the transistor is OFF (non-continuity state).
2. This is provided only with the type having the RS-485 function.

List of Parameters

■Basic functions <default state>

Function	Parameter	Name	Setting range	Minimum setting unit	Default setting
Basic functions	0	Torque boost	0~15%	0.1%	6%/5%/4% (Note 4)
	1	Maximum frequency	0~120Hz	0.1Hz	60Hz
	2	Minimum frequency	0~120Hz	0.1Hz	0Hz
	3	Base frequency	0~120Hz	0.1Hz	60Hz
	4	Multi-speed setting (high speed)	0~120Hz	0.1Hz	60Hz
	5	Multi-speed setting (medium speed)	0~120Hz	0.1Hz	30Hz
	6	Multi-speed setting (low speed)	0~120Hz	0.1Hz	10Hz
	7	Acceleration time	0~999 s	0.1 s	5 s
	8	Deceleration time	0~999 s	0.1 s	5 s
	9	Electronic thermal O/L relay	0~50A	0.1A	Rated output current (Note 3)
	30	Extended function display selection	0, 1	1	0
	79	Operation mode selection	0~4, 7, 8	1	0

(Notes) 1. The shaded parameters can be changed even during operation.
2. This parameter is provided only with the type having the RS-485 communication function.
3. This will be 85% of the rated output current for 0.75K or less.
4. This will be 5% for FR-S540-1.5K and 2.2K, and 4% for FR-S540-3.7K.

■Extended functions

By setting parameter 30 to 1, the following extended function parameters can be set.

Function	Parameter	Name
Standard operation functions	10	DC injection brake operation frequency
	11	DC injection brake operation time
	12	DC injection brake voltage
	13	Starting frequency
	14	Load pattern selection
	15	JOG frequency
	16	JOG acceleration/deceleration time
	17	RUN key rotation direction selection
	19	Base frequency voltage
	20	Acceleration/deceleration reference frequency
	21	Stall prevention function selection
	22	Stall prevention operation level
	23	Stall prevention operation level compensation factor at double speed
	24	Multi-speed setting (speed 4)
	25	Multi-speed setting (speed 5)
	26	Multi-speed setting (speed 6)
	27	Multi-speed setting (speed 7)
	28	Stall prevention operation reduction starting frequency
	29	Acceleration/deceleration pattern
	31	Frequency jump 1A
	32	Frequency jump 1B
	33	Frequency jump 2A
	34	Frequency jump 2B
	35	Frequency jump 3A
	36	Frequency jump 3B
	37	Speed display
	38	Frequency setting voltage gain frequency
	39	Frequency setting current gain frequency
	40	Start-time ground fault detection selection
Output terminal functions	41	Up-to-frequency sensitivity
	42	Output frequency detection
	43	Output frequency detection at reverse rotation
2nd functions	44	2nd acceleration/deceleration time
	45	2nd deceleration time
	46	2nd torque boost
	47	2nd V/F (base frequency)
Current detection	48	Output current detection level
	49	Output current detection signal delay time

Function	Parameter	Name	
Current detection	50	Zero current detection level	
	51	Zero current detection time	
Display functions	52	Control panel display data selection	
	53	Frequency setting operation selection	
	54	FM terminal function selection	
	55	Frequency monitor reference	
	56	Current monitor reference	
Restart	57	Restart coasting time	
	58	Restart cushion time	
Remote setting	59	Remote setting function selection / Frequency setting storage function selection	
Terminal function selection	60	RL terminal function selection	Can be selected with the RL, RM, RH, RT, AU, STOP, MRS, OH, REX, JOG, RES, X14, X16 and STR signals. (The STR signal can be assigned only with Pr. 63.)
	61	RM terminal function selection	
	62	RH terminal function selection	
	63	STR terminal function selection	
	64	RUN terminal function selection	Can be selected with the RUN, SU, OL, FU, RY, Y12, Y13, FDN, FUP, RL, LF and ABC signals.
	65	A, B, C terminal function selection	
Operation selection functions	66	Retry selection	
	67	Number of retries at alarm occurrence	
	68	Retry waiting time	
	69	Retry count display erase	
	70	Soft-PWM setting	
	71	Applicable motor	
	72	PWM frequency selection	
	73	0 to 5V/0 to 10V selection	
	74	Input filter time constant	
	75	Reset selection/ PU stop selection	
	76	Cooling fan operation selection	
	77	Parameter write disable selection	
	78	Reverse rotation prevention selection	
Multi-speed operation functions	80	Multi-speed setting (speed 8)	
	81	Multi-speed setting (speed 9)	
	82	Multi-speed setting (speed 10)	
	83	Multi-speed setting (speed 11)	
	84	Multi-speed setting (speed 12)	
	85	Multi-speed setting (speed 13)	
	86	Multi-speed setting (speed 14)	
	87	Multi-speed setting (speed 15)	

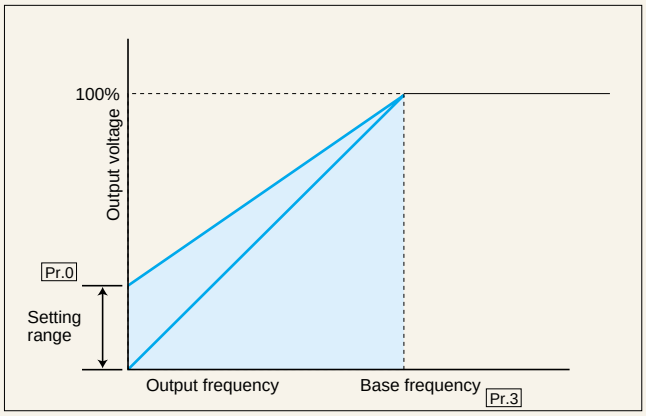
Function	Parameter	Name
PID control	88	PID operation selection
	89	PID proportional band
	90	PID integral time
	91	PID upper limit
	92	PID lower limit
	93	PID control set point during PU operation
	94	PID differential time
Slip compensation	95	Motor rated slip
	96	Slip compensation time constant
	97	Constant output area slip compensation selection
Automatic torque boost	98	Automatic torque boost selection (motor capacity)
	99	Motor primary resistance
Communication/PU function (Note 2)	n 1	Communication station number
	n 2	Communication speed
	n 3	Stop bit length
	n 4	Parity check presence/absence
	n 5	Number of communication retries
	n 6	Communication check time interval
	n 7	Wait time setting
	n 8	Operation command write
	n 9	Speed command write
	n 10	Link start mode selection
	n 11	CR/LF selection
	n 12	E^2PROM write validity selection
	n 13	PU display language
	n 14	PU buzzer sound control
	n 15	PU contrast adjustment
	n 16	PU main display screen data selection
	n 17	PU dislocation detection/PU setting lock
Calibration functions	c 1	FM terminal calibration
	c 2	Frequency setting voltage bias frequency
	c 3	Frequency setting voltage bias
	c 4	Frequency setting voltage gain
	c 5	Frequency setting current bias frequency
	c 6	Frequency setting current bias
	c 7	Frequency setting current gain
	c 8	Parameter for manufacturer setting. Do not set.
Auxiliary functions	CLr	Parameter clear
	ECL	Alarm history clear

Explanation of Parameters

"Pr." is the abbreviation of parameter.

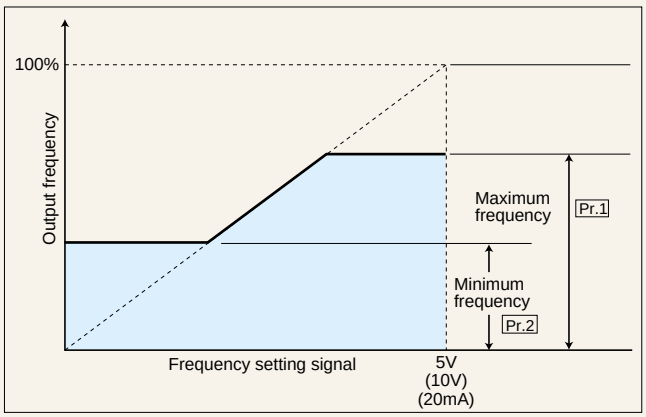
Pr.0 Torque boost

●The motor torque in the low frequency area can be adjusted according to the load.



Pr.1 Pr.2 Maximum/minimum frequency

●The upper limit and lower limit of the output frequency is clamped.



Pr.3 Base frequency

●Set the base frequency (reference frequency for motor rated torque) between 0 and 120Hz according to the motor.

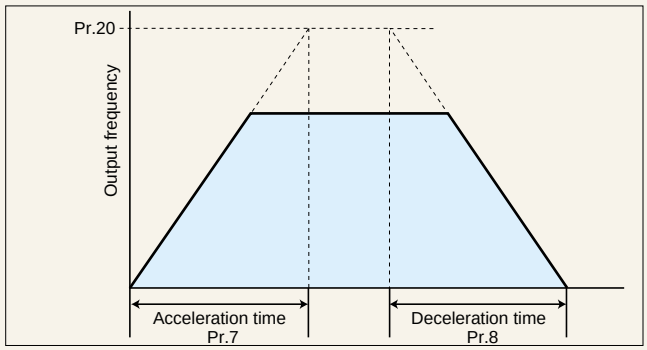
Pr.4 Pr.5 Pr.6 Multi-speed setting

●Various speeds (RH, RM, RL) can be selected just by changing the contact signal from an external source.

●Each speed (frequency) can be set between 0 and 120Hz while the inverter is running.

Pr.7 Pr.8 Acceleration/deceleration time

●For the acceleration time, set the time to reach the acceleration/deceleration reference frequency Pr. 20 (default value: 60Hz) from 0Hz, and for the deceleration time, set the time to reach 0Hz from Pr. 20 (default value: 60Hz).



Pr.9 Electronic thermal O/L relay

●The setting value to protect the motor from overheating can be set as a current value. Normally, the motor rated current is set for 50Hz.

●When 0A is set, the motor protective function will not activate. (The inverter output transistor's protective function will activate.)

●When connecting multiple motors, set an external thermal relay for each motor.

Pr.30 Extended function display selection

●Set this to display and set the extended function parameters.

Setting value	Details
0	Display only basic functions
1	Display all parameters

Pr.79 Operation mode selection

●The inverter operation modes include operation with external signal and operation with the PU (setting dial, touch keys). The mode can be fixed to one mode, or two modes can be used together.

※Refer to the Instruction Manual for details.

Setting value	Details	
0	Operation is possible by changing between PU (setting dial, touch key) operation or external operation.	
1	Operation is possible only with PU (setting dial, touch key) operation.	
2	Only external operation is possible.	
3	Operation frequency	Starting signal
	Setting with setting dial · Multi-speed selection · 4 to 20mADC input	External terminal (STF/STR)
4	Operation frequency	Starting signal
	External terminal signal (Multi-speed, 0 to 5VDC, etc.)	RUN key
7	PU operation interlock	
8	Operation mode external signal changeover Select operation mode by turning PU operation/external operation mode changeover (X16) signal ON and OFF.	

Alarm Displays

Protective function name		Main LED display	Fault class (Note 3)
Overcurrent cutoff	Accelerating	OC1	Major fault
	Constant speed	OC2	Major fault
	Decelerating	OC3	Major fault
Regenerative overvoltage cutoff	Accelerating	Ou1	Major fault
	Constant speed	Ou2	Major fault
	Decelerating	Ou3	Major fault
Overload cutoff (electronic thermal overcurrent protection)	Transistor	THT	Major fault
	Motor	THM	Major fault
Fin overheat		FIN	Major fault

Protective function name		Main LED display	Fault class (Note 3)
Fan trouble		FN	Minor fault
Stall prevention	Overload	OLT	Major fault
	Overcurrent speed loss	OL	—
	Overvoltage speed loss	oL	—
External thermal relay (Note 1)		OHT	Major fault
PU disconnected (Note 2)		PUE	Major fault
Output side ground fault protection (Note 5)		GF	Major fault
Retry count		rET	Major fault
Parameter memory element error		PE	Major fault

Protective function name		Main LED display	Fault class (Note 3)
Communication error (Note 2)		OPT	Major fault
CPU error		CPU	Major fault
Undervoltage (Note 4)		UU	—
Parameter setting error	Write disable error	Er1	—
	Write-while running error/ mode designation error	Er2	—
	Calibration error	Er3	—

(Notes) 1. This functions only when the external thermal relay input (OH) is selected with Pr. 60 to Pr. 63 (input terminal function selection).
2. This applies only when the RS-485 communication function is provided.
3. Major fault : The protective function activates, inverter output is shut off, and an error output is provided.
Minor fault : Output is not shut off even when the protective function activates. It is possible to output minor fault signals by making parameter settings.
4. An error is not output when an undervoltage occurs, but the inverter output is cut off. The operation can be resumed after the power is recovered.
5. This activates only when Pr. 40 (ground fault detection at starting selection) is set to 1.
6. Refer to the instruction manual for details on PS and Err displays.

Selecting Peripheral Devices

Power voltage	Motor output (kW)	Applicable inverter type	No-fuse breaker (NFB) Earth leakage breaker (NV)	Magnetic contactor (MC)	Wire (mm^2) (Note 1)	
					R,S,T	U,V,W
3-phase 200V	0.1	FR-S520-0.1K(-R,C)	30AF 5A	S-N10	2	2
	0.2	FR-S520-0.2K(-R,C)	30AF 5A	S-N10	2	2
	0.4	FR-S520-0.4K(-R,C)	30AF 5A	S-N10	2	2
	0.75	FR-S520-0.75K(-R,C)	30AF 10A	S-N10	2	2
	1.5	FR-S520-1.5K(-R,C)	30AF 15A	S-N10	2	2
	2.2	FR-S520-2.2K(-R,C)	30AF 20A	S-N11,S-N12	2	2
	3.7	FR-S520-3.7K(-R,C)	30AF 30A	S-N20	3.5	3.5
3-phase 400V	0.4	FR-S540-0.4K(-R)	30AF 5A	S-N10	2	2
	0.75	FR-S540-0.75K(-R)	30AF 5A	S-N10	2	2
	1.5	FR-S540-1.5K(-R)	30AF 10A	S-N10	2	2
	2.2	FR-S540-2.2K(-R)	30AF 15A	S-N20	2	2
	3.7	FR-S540-3.7K(-R)	30AF 20A	S-N20	2	2

Power voltage	Motor output (kW)	Applicable inverter type	No-fuse breaker (NFB) Earth leakage breaker (NV)	Magnetic contactor (MC)	Wire (mm^2) (Note 1)	
					R,S,T	U,V,W
Single-phase 200V	0.1	FR-S520S-0.1K(-R)	30AF 5A	S-N10	2	2
	0.2	FR-S520S-0.2K(-R)	30AF 10A	S-N10	2	2
	0.4	FR-S520S-0.4K(-R)	30AF 10A	S-N20	2	2
	0.75	FR-S520S-0.75K(-R)	30AF 15A	S-N20	2	2
	1.5	FR-S520S-1.5K(-R)	30AF 20A	S-N21	2	2
Single-phase 100V	0.1	FR-S510W-0.1K(-R)	30AF 10A	S-N10	2	2
	0.2	FR-S510W-0.2K(-R)	30AF 15A	S-N10	2	2
	0.4	FR-S510W-0.4K(-R)	30AF 20A	S-N20	2	2
	0.75	FR-S510W-0.75K(-R)	30AF 30A	S-N20	3.5	2

(Note) 1. The wire size is for a wiring length of 20m.

List of Options

	Name	Type	Application and specifications, etc.		Applicable inverter
Stand alone type	Parameter unit (8 languages)	FR-PU04	Interactive parameter unit with LCD display	Can be used only with FR-S5□□-□K-R type with RS-485 communication function	Type with RS-485 communication function
	Cable for connecting parameter unit	FR-CB201(1m) FR-CB203(3m) FR-CB205(5m)	Cable for connecting parameter unit and inverter		
	Power factor improvement AC reactor	FR-BAL(H)□□(Note 2)(Note 8)	For power factor improvement (power factor approx. 90%)	Connect to input side	Compatible with 0.1K to 3.7K capacities
	Power factor improvement DC reactor	FR-BEL(H)□□(Note 2)(Note 6)(Note 8)	For power factor improvement (power factor approx. 95%)		
	Radio noise filter	FR-BIF(H)(Note 8)	Reduces radio noise	Connect to input side	Common for all models
	Line noise filter	FR-BSF01	Reduces line noise		
	Surge voltage suppression filter	FR-ASF-H□□ (Note 2)	For micro-surge voltage suppression		Compatible with FR-S540-0.4K to 3.7K capacities
	BU type brake unit	BU(H)□□(Note 2)(Note 8)	Greatly increases regenerative braking performance		FR-S520-0.4K to 3.7K FR-S540-2.2K to 3.7K
	Discharging resistor	GZG GRZG type	Discharging resistor for BU type brake unit		
	High power factor converter	FR-HC-(H)7.5K(Note 8)	For suppressing higher harmonics		FR-S520-0.1K to 3.7K(Note 4) FR-S540-0.4K to 3.7K(Note 4)
	Power regeneration common converter	FR-CV-□□ (-AT) (Note 2) (Note 9)	Common converter type power regeneration brake unit		(Compatible with FR-S520-0.1K to 3.7K capacities)
	Dedicated standalone reactor	FR-CVL-□□ (Note 2)	Reactor for power regeneration common converter		
	EMC command compatible noise filter (EU compatible)	SF-□□(Note 3) FR-S5NFSA-□□(Note 2) FR-E5NF-H□□(Note 2)	EMC Instruction (EN50081-2) compatible noise filter * Measures must be taken to prevent malfunction of peripheral devices (earth leakage breaker), etc., and electric shocks caused by leakage currents.		Compatible with FR-S520-0.1K to 3.7K (Note 5), FR-S520S-0.1K to 1.5K, FR-S510W-0.1K to 0.75K (Note 7) capacities FR-S540-0.4K to 3.7K
	EMC filter installation attachment	FR-E5T	Attachment for installing EMC instruction compatible noise filter (SF1309) onto inverter		FR-S520-2.2K/3.7K
	DIN rail installation attachment	FR-UDA01 FR-UDA02 FR-UDA03	DIN rail installation		Compatible with capacities
FR series controllers and setters(Note 1)	Operation box with frequency meter	FR-AX	For independent operation with frequency meter, frequency setting unit and start switch		Common for all models
	Sequential setting operation box	FR-AL	For sequential operation (1VA) with external signals (0 to 5VDC, 0 to 10VDC)		
	3-speed setting operation box	FR-AT	For operation changing between high, medium and low speed (1.5VA)		
	Remote operation box	FR-FK	For remote operation; operation from several places is possible (5VA)		
	Ratio setting box	FR-FH	For ratio operation; ratios for up to five inverters can be set.		
	PG follower	FR-FP	For follow-up operation using the signal of a pilot generator (PG). (2VA)		
	Master controller	FR-FG	Main speed setting unit for parallel operation of several inverters (up to 35 units). (5V)		
	Inclined signal box	FR-FC	For soft starting/stopping; parallel operation acceleration/deceleration is possible (3VA)		
	Deviation detector	FR-FD	For synchronous operation. Used with deviation sensor and synchro. (5VA)		
	Pre-amplifier box	FR-FA	Can be used as A/V converter or operation amplifier (3VA)		
	Pilot generator	QVAH-10	70/35VAC 500Hz for tracking operation (at 2500r/min)		
	Deviation sensor	YVGC-500W-NS	For synchronous operation (mechanical deviation detection). Output 90VAC/90°		

(Notes) 1. Rated power consumption for the FR Series operation and setting box power supply specifications are 200VAC 50Hz, 200/220V 60Hz, 115VAC 60Hz.
2. The values given in boxes indicate the capacity.
3. □□ indicates a value.
4. One 3.7K inverter must be connected. (When using without the 3.7K inverter connected, use as a common converter or regenerative converter is possible, but the power higher harmonic suppression effect will drop.)
5. The EMC filter installation attachment (FR-E5T) must be used when installing SF filter on the FR-S520-2.2K/3.7K.
6. This cannot be mounted on the single-phase 100V power input specification product.
7. A 0.75K filter capacity is used for the 0.4K or less inverter capacity, and a 1.5K filter capacity is used for the 0.75K inverter capacity.
8. The 3-phase 400V input specification product is indicated with an "H" in the type.
9. -AT indicates the type installed in the panel. If -AT is not added, this is an external cooling fin type. Note that either method can be used for the 37K and 55K types by changing the position of the installation legs, so -AT is not added.

Precautions

⚠For Maximum Safety

- Always read the instruction manual before use to use the equipment properly and safely.
- This product is not designed or manufactured to be used in equipment or systems in situations that can affect or endanger human life.
- When considering this product for operation in special applications such as equipment or systems used in passenger transportation, medical, aerospace, nuclear energy, electric power, or submarine relay applications, please contact your nearest Mitsubishi sales department.
- Although this product was manufactured under strict quality control conditions, it is strongly advised to install safety devices to forestall serious accidents when used in facilities where a breakdown of the product is likely to cause a serious accident.
- Please do not use for loads other than 3-phase induction motors.

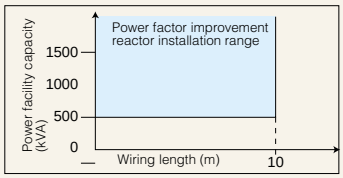
Cautions for Use

■Operation

- When a magnetic contactor (MC) is installed on the primary side, do not start and stop operation frequently with this MC. Failure to observe this could lead to inverter faults.
- When a fault occurs in the inverter, the protective function will activate and the output will stop, but the motor will not stop immediately. Thus, if the machine or facility requires emergency stop means, install mechanical stopping and holding mechanism.

■Power supply

- If the unit is installed directly below a large-capacity power supply transformer (500kVA or more, with wiring length of 10m or less), or where the phase advance capacitor switches, an excessive peak current may flow to the power input circuit causing damage to the inverter. In this case, be sure to install the optional FR-BEL or FR-BAL power factor improvement reactor.
- If surge voltage is generated in the power system, this surge energy could flow into the inverter and cause the inverter to stop with the OV1, OV2 or OV3 alarm displayed. In this case, install the optional power factor improvement reactor FR-BEL or FR-BAL.



■Wiring distance

- If the wiring is long, the charging current caused by the suspended capacity of the wiring may cause the fast response current limit function to activate. Make sure that the maximum wiring length is less than the values in the table below.

Inverter capacity		0.1K	0.2K	0.4K	0.75K	1.5K	2.2K	3.7K
During non-low noise operation	100V class 200V class	100m	100m	100m	100m	100m	100m	100m
	400V class	–	–	50m	100m	100m	100m	100m
During low-noise operation	100V class 200V class	30m	30m	100m	100m	100m	100m	100m
	400V class	–	–	30m	30m	100m	100m	100m

- When automatic torque boost is selected, make sure that the length of the wiring between the inverter and motor is 30m or less.

■Grounding

- When the inverter is run with low-noise, the leakage current will increase because of the high-speed switching compared to the non-low noise operation. Always ground the inverter and motor. Always use the inverter's grounding terminal to ground the inverter.
- For 400V class, make save to ground the supply nevtral.

■Noise

When carrying out low-noise operation with the carrier frequency increased, the magnetic noise will tend to increase. Refer to the following countermeasures, and act accordingly. Depending on the installation state, the effect of noise may be apparent even during non-low noise operation (default state).
The radio noise filter FR-BIF is effective against static noise heard in AM radio broadcasts.

■Leakage current

Electrostatic capacitance occurs between the inverter's input/output wiring, other wiring, grounding and motor. The leakage current can flow through these and cause the earth leakage breaker, leakage relay and external thermal to operate unnecessarily. Take measures by lowering the Pr. 72 carrier frequency, using harmonics and surge compatible parts for the earth leakage breaker, and using an electronic thermal O/L relay built into the inverter.

Safety Warning

To ensure proper use of the products listed in this catalog, please be sure to read the instruction manual prior to use.

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